

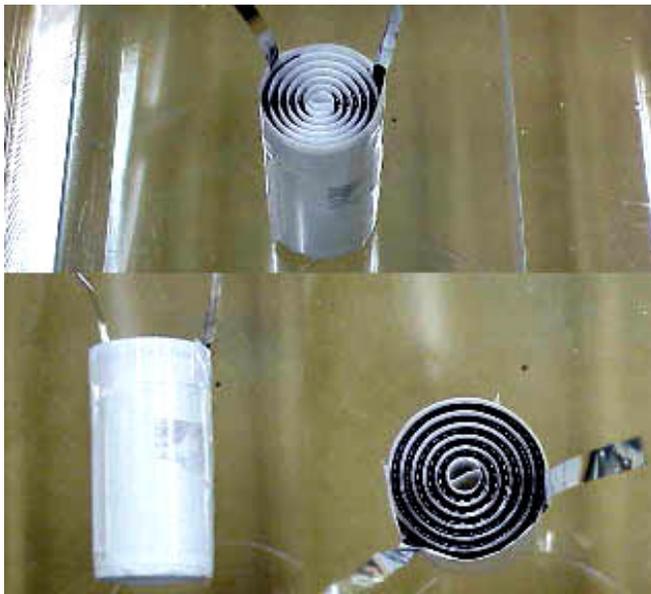
TECHNOLOGY FACT SHEET

LONGER LASTING LITHIUM/OXYGEN BATTERY

(Zhang, Foster, Read)

Introduction

The invention signals a substantial new advance in lithium/oxygen battery (Li/Air) development. Researchers at the U.S. Army Research Laboratory–Sensors and Electron Devices Directorate (ARL-SEDD) in Adelphi, Maryland designed, built and tested a new non-aqueous electrolyte that improves running voltage and significantly increases storage capacity beyond other state-of-practice Li/Air cells.



ARL-SEDD Lithium/Air Cell (source: SEDD)

Concept

It is estimated that U.S. vehicles use the equivalent of seven million barrels of gasoline each day. In an effort to replace this enormous consumption with environmentally sound alternatives, battery researchers are exploring the promise of Li/Air battery technology to power our transportation needs. Li/Air batteries have the highest theoretical energy density among primary (non-rechargeable) battery chemistries (see chart on following page). However, in practice the actual energy density of these types of batteries has fallen well short of expectations. The ARL invention advances the state-of-practice by doubling the specific capacity over existing lithium/oxygen batteries under development. This step-change in capacity could pave the way for a new generation of applications that require higher energy-density primary batteries.

Invention Overview

- ❖ *Novel electrolyte solution results in up to twice the specific capacity of current lithium/oxygen cells*
- ❖ *Costs less than existing electrolyte solutions*
- ❖ *TRL 6 – Fully functioning manufacturing prototype cells*
- ❖ *Test data available*

Doing Business with ARL

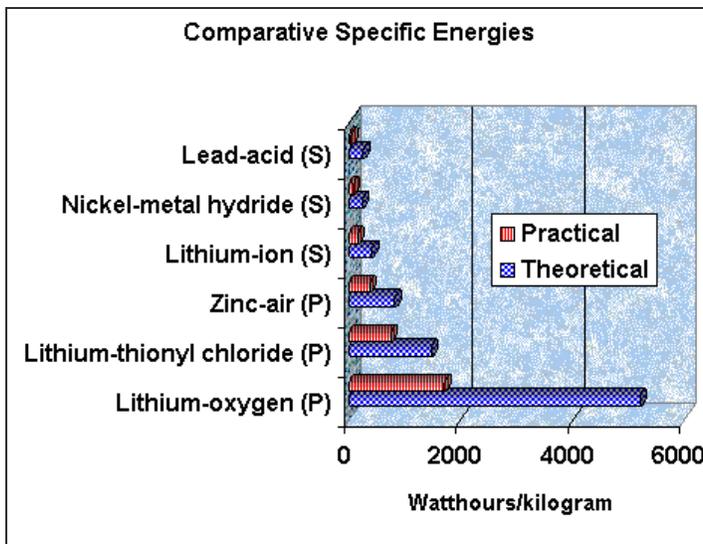
- ❖ *ARL-SEDD is a leader in partnering with domestic firms*
- ❖ *Successfully developed and implemented innovative tools to ease the technology transfer process*
- ❖ *Tools includes Patent License Agreements (PLAs); Cooperative Research and Development Agreements (CRADAs); Test Services Agreement (TSA); and others*
- ❖ *Visit www.arl.army.mil for more information*

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Features/Capabilities/Intellectual Property

In addition to the significant increase in specific capacity, laboratory tests show that the initial discharge voltage of the Li/Air cells using the ARL invention can reach as high as 3.1 V at moderate current rate (0.2 mA/cm²), exactly equaling the theoretical value (3.10 V). Also, the running voltage has been demonstrated to outpace other Li/Air cells by 200 mV. The cost of the new electrolyte salt is no more than and perhaps slightly lower (~5%) than other commonly used salts, such as LiBF₄. Moreover, barriers to adoption of the ARL technology should be minimal since procedures for making the new salts are the same as the present LiBF₄ salt, just with different precursor chemicals. Other features/capabilities/intellectual property offered by this invention include the following:

- Greater number of potential applications
- Fits existing battery formats
- IP includes novel composition of matter and the assembled battery using the ARL invention



Potential Markets/Applications

The invention discloses an electrolyte solution that provides Li/air batteries with significantly improved capacity and discharge performance. The ARL invention benefits both military and commercial battery applications. In addition to the use in the field charger of military equipment, Li/Air batteries also can be used in the commercial electronic devices that are required for long-term consecutive operations, such as radio and forecast stations.

Key Advantages & Benefits

- ❖ Improves running voltage by 200mV over similarly constructed Li/Air cells
- ❖ Drop-in technology for existing Li/Air cells currently under development
- ❖ The cost for new electrolyte is slightly lower (~5%) than the competing electrolyte (LiBF₄)
- ❖ No change in battery format needed
- ❖ Inventor team will work with commercialization partner

Contact Information

This technology was developed by ARL-SEDD. It is now available for licensing and CRADA opportunities.

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